WHAT IS CLAIMED IS:

1. A grating-outcoupled microcavity disk resonator, defining a plane and having a substantially smooth curved outer periphery, bounded by reflective walls, around and within which light can circulate, the resonator including at least one grating region disposed in the plane of the grating-outcoupled microcavity disk resonator, the grating region serving to outcouple light circulating within the curved outer periphery into free space modes propagating out of the plane of the resonator.

2. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region is a set of periodic features formed in or on a cladding layer of the resonator.

3. The grating-outcoupled microcavity disk resonator of claim 2, wherein the periodic features have at least one of a trapezoidal shape, a rectangular shape, a sinusoidal shape, a sawtooth shape and an asymmetric shape.

4. The grating-outcoupled microcavity resonator of claim 1, wherein the grating region exists in at least one region near the outer periphery.

5. The grating-outcoupled microcavity disk resonator of claim 4, wherein each of the at least one region includes a grating having a periodicity that is different from the other regions.

6. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region extends around an entire circumference of the resonator.

7. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region forms at least a second-order grating.

8. The grating-outcouple microcavity disk resonator of claim 1, wherein the grating region forms a distributed feedback grating.

9. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region includes dielectric material formed in stripes on or over a waveguide layer.

10. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region includes conductive material formed in stripes on or over a cladding layer, wherein the conductive material is at least one of at least one metal layer and a conductive oxide.

11. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region includes conductive material formed in stripes on or over a top electrode layer.

12. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region comprises a set of pillars separated by voids.

13. The grating-outcoupled microcavity disk resonator of claim 12, wherein the pillars are at least one of rectangular, trapezoidal, sinusoidal, and asymmetric in shape.

14. The grating-outcoupled microcavity disk resonator of claim 12, wherein the grating region has a dielectric material filling the voids between the parallel pillars.

15. The grating-outcoupled microcavity disk resonator of claim 1, further comprising a reflective layer associated with the grating region.

16. The grating-outcoupled microcavity disk resonator of claim 15, wherein the reflective layer reflects a wave which constructively interferes with a diffracted wave generated by the grating region.

17. The grating-outcoupled microcavity disk resonator of claim 15, wherein the reflective layer is displaced by a multiple of about $\lambda/2$ from the grating region, wherein λ is a wavelength of the light traveling within the disk resonator.

18. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region is a set of periodic features formed in an upper cladding layer of the grating-outcoupled microcavity disk resonator.

19. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region is formed in an upper cladding layer and an upper waveguide layer of the grating-outcoupled microcavity disk resonator.

20. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating region is formed in both a top cladding layer and a bottom cladding layer of the grating-outcoupled microcavity disk resonator.

21. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating-outcoupled microcavity disk resonator further comprises a plurality of grating-outcoupled microcavity disk resonators, each grating-outcoupled microcavity disk resonator defining a plane and each grating-outcoupled microcavity disk resonator having at least one grating region disposed in the plane of that grating-

outcoupled microcavity disk resonator, each at least one grating region serving to outcouple light circulating in the corresponding grating-outcoupled microcavity disk resonator in a direction out of the plane of that grating-outcoupled microcavity disk resonator.

22. The grating-outcoupled microcavity disk resonator of claim 21, wherein each of the plurality of grating-outcoupled microcavity disk resonators resonates at a different wavelength.

23. The grating-outcoupled microcavity disk resonator of claim 21, wherein each of the plurality of grating-outcoupled microcavity disk resonators has a different diameter.

24. The grating-outcoupled microcavity disk resonator of claim 21, wherein the plurality of grating-outcoupled microcavity disk resonators are stacked concentrically.

25. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating-outcoupled microcavity disk resonator comprises a III-V nitride semiconductor heterostructure formed on a substrate.

26. The grating-outcoupled microcavity disk resonator of claim 25, wherein the substrate comprises at least one of sapphire, silicon carbide, GaN, AlGaN, AlN, and silicon.

27. The grating-outcoupled microcavity disk resonator of claim 25, wherein the III-V nitride semiconductor heterostructure comprises at least one quantum well.

28. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating-outcoupled cavity resonator comprises a heterostructure formed using at least one of GaAs, InAs, AlAs, InP, AlP, and GaP.

29. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating-outcoupled microcavity disk resonator comprises a heterostructure formed using at least one of InGaAs, AlGaAs, InAlAs, InGaAsP, InGaP, and InAlP.

30. The grating-outcoupled microcavity disk resonator of claim 1, wherein the grating-outcoupled microcavity disk resonator comprises a heterostructure formed using at least one of ZnSe, CdS, MgS, MgSe, CdSe, CdTe, ZnO, and MgO.

31. The grating-outcoupled microcavity disk resonator of claim 1, wherein a central portion of the grating-outcoupled microcavity disk resonator has been removed.

32. The grating-outcoupled microcavity disk resonator of claim 31, wherein a remaining portion of the grating-outcoupled microcavity disk resonator is an annulus.

33. A grating-outcoupled microcavity disk resonator, defining a plane and having a substantially smooth curved outer periphery, bounded by reflective walls, around and within which light can circulate, the resonator including at least one grating region disposed in the plane of the cavity resonator, the at least one grating region disposed at an angle with respect to the circulating light, the grating region serving to outcouple the circulating light into free space modes propagating out from the resonator substantially in the plane of the resonator.

34. The grating-outcoupled microcavity disk resonator of claim 33, wherein the grating region forms a first-order diffraction grating.

35. The grating-outcoupled microcavity disk resonator of claim 33, wherein a propagation direction of the free-space modes is radially outward from the resonator.

36. A method of manufacturing a grating-outcoupled microcavity disk resonator, comprising:

forming a waveguide layer having a first index of refraction;

forming a cladding layer having a second index of refraction;

forming a periodic topography in a portion of at least one of the waveguide layer and the cladding layer, wherein the periodic topography lies between the waveguide layer and the cladding layer to form a grating; and

etching the waveguide layer and the cladding layer to form a substantially smooth curved outer peripheral wall of the microcavity disk resonator.

37. The method of claim 36, wherein forming the periodic topography comprises forming a set of dielectric stripes over the waveguide layer, and then forming the cladding layer over the dielectric stripes.

38. The method of claim 36, wherein forming the periodic topography comprises etching a set of indentations in the waveguide layer, and forming the cladding layer over the indentations.

39. The method of claim 38, wherein etching the indentations comprises at least one of wet etching, dry etching, or chemically-assisted ion beam etching the waveguide layer.

40. A method of manufacturing a grating-outcoupled microcavity disk resonator, comprising:

forming a waveguide layer over an active region of the cavity resonator;

forming a cladding layer over the waveguide layer;

forming a periodic topography in a portion of the cladding layer to form a grating; and

etching the active region, the waveguide layer, and the cladding layer to form a substantially smooth curved outer peripheral wall of the cavity resonator.

41. The method of claim 40, wherein the periodic topography comprises a set of at least one of sawtooth voids, rectangular voids, asymmetrical voids or sinusoidal voids formed in the cladding layer.

42. The method of claim 41, further comprising depositing a dielectric material into the voids formed in the cladding layer.

43. The method of claim 41, further comprising depositing a reflective material into the voids formed in the cladding layer.

44. The method of claim 40, wherein forming the periodic topography comprises at least one of wet etching, dry etching, or chemically-assisted ion beam etching the cladding layer.

45. The method of claim 40, wherein etching the active region, waveguide layer and cladding layer to form the substantially smooth curved outer peripheral wall comprises at least one of wet etching, dry etching or chemically-assisted ion beam etching.

46. The method of claim 40, further comprising forming a metal electrode layer on or over the cladding layer before forming the periodic topography in the cladding layer.

47. A method of manufacturing a grating-outcoupled microcavity disk resonator, comprising:

forming a waveguide layer over an active region of the cavity resonator;

forming a cladding layer over the waveguide layer;

forming a periodic topography over a portion of the cladding layer to form a grating; and

etching the active region, the waveguide layer, and the cladding layer to form a substantially smooth curved outer peripheral wall of the cavity resonator.

48. The method of claim 47, wherein forming the periodic topography comprises forming a set of metallic stripes over a portion of the cladding layer to form a grating.

49. The method of claim 47, wherein forming the periodic topography comprises forming a set of dielectric stripes over a portion of the cladding layer to form a grating.

50. A method of manufacturing a grating-outcoupled microcavity disk resonator, comprising:

forming a waveguide layer;

forming a cladding layer on or over the waveguide layer;

forming an electrode contact on or over the cladding layer;

forming a set of metallic stripes on or over a portion of the electrode contact to form a grating; and

etching the active region, the waveguide layer, the cladding layer, and the electrode contact to form a substantially smooth curved outer peripheral wall of the cavity resonator.